# PREFACE

*Extruded Cordierite honeycombs are used as substrates for catalytic converters in automotive emission control Thermal and mechanical properties of honeycomb monoliths are important for design criteria since monoliths have to withstand thermal stresses and vibrational load during use Cordierite (2MgO $2Al_2O_3$ $5SiO_2$ ) material offers very good thermal shock resistance due to its low thermal expansion Anisotropy of thermal expansion in this material is advantageously used in honeycomb products to get very low thermal expansion in the extrusion direction by preferential orientation of cordierite c-axis in the extrusion direction*

*In this research work an attempt is made to investigate the effect of induced preferred orientation imparted during extrusion of cordierite bodies on thermal expansion behavior Cordierite ceramics which have intrinsic thermal expansion anisotropy were made from indigenously available raw materials and investigated for formation, thermal expansion and mechanical properties*

*The starting raw materials like clay, talc and alumina were characterized for chemical composition and particle size distribution Stoichiometric cordierite compositions were prepared from these materials by mixing in appropriate amounts Honeycomb ceramic bodies were extruded from the same batch with wall thickness of 0 15, 0 17, 0 22 and 0 38mm and cell density of 400 thin, 400, 200 and 80 cpsi (Cells Per Square Inch) The green honeycombs were fired at 1390°C for 4 hrs to get cordierite phase XRD, DTA techniques showed cordierite phase as the only crystalline phase*

*Four types of honeycombs were evaluated for the following properties i) Bulk density and porosity, ii) Thermal expansion iii) Modulus of Rupture both at room temperature and at 900 °C iv) Modulus of Elasticity v) Compression strength in 3 directions vi) Pore volume and Pore size distribution and vii)Thermal shock resistance parameter*

*Coefficient of thermal expansion (CTE) is found to decrease with increase in honeycomb wall thickness The lowest CTE (1 72 x $10^{-6}$ / °C) is obtained for 80* *cpsı honeycomb havıng 0 38 mm wall thıckness and hıghest CTE ıs ( 2 0 X $10^{-6}$ / °C) for 400thın honeycomb havıng 0 15 mm thıckness The propertıes of varıous types of honeycombs tested were satısfactory and are compared wıth values obtaıned from others Mechanıcal propertıes are compared wıth calculated values and are found to vary honeycomb volume ratıo*

*In order to ınvestıgate the effect of wall thıckness and extrusıon parameters on thermal expansıon, cordıerıte rıbbons of 0 5mm and 1 5mm thıckness, extruded at varıous speeds and bulk ısostatıcally pressed pellets were made and subjected to thermal expansıon and XRD studıes Intensıtıes of approprıate X-ray dıffractıon peaks were consıdered to determıne the degree of orıentatıon as a functıon of depth from surface for both green and fıred rıbbon samples*

*Thermal expansıon of varıous samples were measured up to 850 °C ın dırectıons parallel and perpendıcular to extrusıon CTE ıs calculated ın the lınear regıon of 400 to 750 °C by lınear curve fıttıng Thermal expansıon ıs found to be low ın the dırectıon parallel to extrusıon (1 77 to 1 96 x $10^{-6}$ / °C) and hıgh ın the dırectıon perpendıcular to extrusıon (2 50 to 2 91 x $10^{6}$ / °C) ın all the samples measured Thıs may be attrıbuted to the preferentıal orıentatıon of c-axıs of cordıerıte ın extrusıon dırectıon*

*The study of honeycombs and extruded rıbbons showed that thermal expansıon propertıes are sensıtıve to the degree of preferred orıentatıon ınduced durıng extrusıon In both cases, the thıcker samples showed hıgher orıentatıon and hence lower thermal expansıon*

*The work presented ın thıs thesıs was carrıed out by the author for the award of M Sc (Engg ) degree from Indıan Instıtute of Scıence, Bangalore The author hopes that the studıes reported ın thıs thesıs form an orıgınal pıece of work and also that ıs a worthwhıle contrıbutıon to ceramıc engıneerıng and materıals technology aspects of the subject*